ON THE

INFLUENCE

OF A

DIGESTIVE HABIT IN THE PRODUCTION OF TUBERCULOSIS,

AND THE

INDICATIONS FOR TREATMENT DRAWN THEREFROM

BY

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ON TUBERCULOSIS.

NOTWITHSTANDING the great advance that has of late years been made in our knowledge of tuberculosis, it is difficult to connect into one consistent whole the opinions entertained regarding the origin, nature, and treatment of this malady. The profession in this country is much indebted to Dr J. Hughes Bennett for those views regarding the essential nature of the disease which he has so perseveringly and successfully urged upon its attention. They are much strengthened by the great success of that treatment which he has founded upon them, and many authorities are now amongst the number of those who believe that the immediate cause of tuberculosis is a deficiency in the chyle of those oily matters which, together with albumen, are essential to the formation of a true nutritive blastema. Most physicians, if they do not go so far, are at least of opinion that deficiency of fats is, in some manner or other, at the root of this condition, and that in the means of supplying that deficiency lies their hope of its successful treatment. In the great majority of cases there is a marked dislike of, and want of power to digest fats, and every effort is made by tonics and other means to overcome this dislike—too often in vain, or with only partial success. Fortunately, in cod-liver oil and the pancreatic emulsion we have this important constituent of food in forms which are easily digested; so that a certain number of patients who have lost the power of ordinary fat-digestion, being able to digest these simple forms, are checked in their downward progress, and have, perhaps, the full power to elaborate the higher fats ultimately restored. But even with these powerful remedies in our hands, the cases in which our oils disagree are not unfrequent, and the numbers still carried off annually by this scourge are very great.

In the following remarks I shall endeavour to show, that by teaching our patients to flee the winter's cold and court a perpetual summer, we are refusing to them the best tonic to fat digestion which nature's generous pharmacopœia offers to our choice, and that, with our cod-liver oil and pancreatic emulsion in our hands, we ought rather to give them the benefit of a continued, but not too severe, winter temperature. Thus we might hope to restore the lost function and re-establish the normal and habitual digestion of oils. Several observing physicians mention, almost with surprise, that many of their patients in the earlier stages of the disease have seemed to derive benefit from a low temperature and to suffer during summer heat. It would be more surprising were the reverse true, for warmth, lessening the oxidation of, and consequent demand for, fats, hastens the establishment of that morbid refusal of them on the part of the digestive organs on which the disease depends; whereas, on the other hand, a cold temperature, by increasing the combustion of fat, gradually rouses the digestive organs to an effort to meet the extra demand. It is in this direction only that we can hope to correct this morbid digestive habit and restore the normal function.

Without entering into the whole subject of tuberculosis, I shall endeavour, under the following heads, to explain my views more particularly :—

1. The digestion and non-digestion of different kinds of food may and do become habitual.

2. The condition of body favouring the development of tuberculosis is a habit of non-digestion of fat.

3. The causes of this habit are such conditions as diminish the consumption of, and consequent demand for fat in the system, *e.g.*, warmth, impure air, want of exercise, &c.

4. In the treatment of this condition the indications are to break this habit, and to restore the lost power of digestion of oils.

5. This will be best done by supplying in increased force what we find to be the chief stimulants to the digestion of fat,—*e.g.*, cold, pure air, exercise, &c.,—and by avoiding all that would tend to confirm the bad habit.

6. Summer is therefore more to be dreaded than winter in the tubercular diathesis, and safety to be sought rather in choosing a cool bracing climate in the former season, than in the opposite and usual course.

1. *The digestion and non-digestion of different kinds of food may and do become habitual.*—Habit is, according to Dr Johnson, " a power or ability of doing anything acquired by frequently doing the same thing," and, as no acts are performed more regularly than those of digestion, it does not seem unreasonable to extend the application of the law of habit to them. The nervous centres presiding over the process of digestion must, like other nervous centres, become educated by being repeatedly exercised in certain directions, and such powers as are the result of this process of education by frequent repetition we are justified in calling habits. But it is not to the nervous

centres alone that we must look for an explanation of these. As the different constituents of our food are operated upon by the secretions of different organs, the functional activity of those which have been most used in digestion will be greatest. Hence, most gastric juice will be secreted by the hunting tribes who consume large quantities of flesh ; most saliva by the inhabitants of warm countries, a great proportion of whose food is starch ; and most bile and pancreatic juice by the fat-digesters of the Arctic regions. These considerations taken together explain what we here mean by habit. We shall find that these habits are governed by every variety of circumstance. In no two places, perhaps in no two individuals, are they exactly alike ; but the most striking differences are to be met with in those who live under the most opposite conditions. Each nation has a dietary, more or less peculiarly its own, originating in the demands set up in the system by permanent surrounding agencies, and modified from period to period by the customs of the people and the alimentary resources of the country. The food of each country is preferred and most easily digested by its own inhabitants ; on the other hand, disturbance of the digestive organs is usually the result of a change of country and diet. This holds true with regard to comparatively slight as well as to great changes. For illustrations of great difference in diet let us take the two following :—We have the Esquimaux habitually consuming large quantities of fat, and showing a great dislike for starchy food,—a typical digester of fats and non-digester of starch ; and, on the other hand, we have the Hindoo living on rice and avoiding the rich hydrocarbons,—an habitual non-digester of fats and digester of starch. In these, as in all other cases, we see that the desire for, and digestion of, different kinds of food are evidently regulated by surrounding agencies, operating through their influence on the chemical changes taking place in the body. But this is not all; for when a particular dietary has been called for and kept up for a considerable time, the functions of the digestive organs become so adapted to it, that, when the conditions giving rise to the necessity for it no longer exist, it continues to be desired and digested. Cases will occur to every one in which Esquimaux or Russians, &c., on going to a warmer climate, have continued to consume and digest unnecessarily large quantities of fatty substances, and have thus suffered greatly from the heat; and we have, on the other hand, the experience of our Arctic explorers, showing that many months have elapsed before such food as seal's liver and walrus blubber have become desirable, although they were from the first, as much as ever, demanded by the severity of the climate. The bilious attacks of Europeans on first visiting the tropics result from the still unbroken habit of fat-digestion; and the phthisis from which negroes and monkeys suffer on going to a colder climate, is attributable to their habitual non-digestion of fat. Most national digestive habits are probably the result of special conditions operating for generations, and consequently, where the change is extreme, acclimatisation has been pronounced impossible, so difficult is it to break these habits. Individual habits, which are of shorter duration, may be more successfully combated. Hence the stubbornness of hereditary disease compared with the same when acquired.

2. *The condition of body favouring the development of tuberculosis is a habit of non-digestion of fat.*—By this I mean a comparative, not a complete, non-digestion. There is abundant evidence to show that in tuberculosis fat-digestion is defective. Almost all writers insist upon

the repugnance felt in most cases for fat; and even where this dislike is not present, and considerable quantities are taken, it is usually met with in the stools, showing that it is not digested. There is, therefore, every reason to believe that this diseased condition depends upon a deficiency of oil, and consequent relative excess of albumen in the nutritive fluid. Admitting this, the question still remains, How does this disproportion between these substances originate? To this no satisfactory answer has as yet been given. To say that it is due to acidity of the alimentary canal does not indicate where or how the departure from the normal condition begins. Acidity is only one of the events in the history of the disease, and may be traced to that general suboxidation which accompanies diminished vitality. Most probably it is to be met with in all cases of tuberculosis which get the length of a post-mortem; but there is no reason to believe that it is the essential beginning of the tendency to the disease. Preceding the deposit of tubercle there is a stage in which deficient energy is the most marked feature, and wherein no actual disease of any kind can be traced. But even here the deficient digestion of fat has become established, only enough being taken into the system to supply the waste of tissue. Such being the case, it only requires some little additional demand to be made upon this small stock of fat to cause actual disease, with deposit of tubercle to commence. Repeated or prolonged exposure to unusual cold is sufficient, by drawing upon the limited supply of carbon, to disturb the balance between the fat and albumen, and thus cause mal-nutrition, with deposit of tubercle, particularly in those organs which are most active during the operation of the exciting cause.

The harmony which will be seen to exist between the recognised causes of tuberculosis and the conditions which favour the non-digestion of fats will most of all support this view.

3. *The causes of this habit are such conditions as diminish the consumption of, and consequent demand for, fat in the system.*—The appetite for, and digestion of, fat are originally regulated by the amount of its combustion in the body. Hence the causes of its habitual non-digestion will be those conditions which diminish that combustion. These may be pretty accurately ascertained by the amount of carbonic acid given off by the lungs under different circumstances.

(*a.*) The temperature of the surrounding medium has a great effect on the amount of carbonic acid thus exhaled, heat diminishing and cold increasing the quantity. Hence cold climates and the winter season, by favouring the combustion of carbon, increase the desire for fat in the food. Warm climates and the summer season, on the other hand, are opposed to fat-digestion. Warmth applied from without in any other way will have the same effect; therefore warm clothing, confinement to warm rooms, the exclusive or excessive use of warm drinks, &c., will tend to establish this habit of deficient fat-digestion.

(*b.*) Clothing has, as we have said, an effect similar to that of increased temperature, but differing in that it checks free perspiration. The non-conducting and close skins worn by the Esquimaux and other northern tribes must therefore greatly conserve the heat, and aid their increased carbon-combustion in resisting the influence of the excessive cold; whereas, on the other hand, the thinnest clothing must be very injurious in hot climates. Dr Livingstone found by experiment that the temperature of the almost naked African was two degrees lower than his own.

(*c.*) Other conditions being the same, increased density of the atmosphere diminishes, and lessened density increases, the activity of the chemical changes dependent on respiration; consequently, in warm climates high altitudes are found to be beneficial to the consumptive, because they are more favourable to fat-digestion than lower-lying places.

(*d.*) A moist state of the atmosphere promotes, and a dry state checks, the exhalation of carbonic acid; but the former checks, and the latter promotes, perspiration. Thus, under the influence of moisture, heat is both formed and retained in the body to a greater extent than is required by the surrounding temperature. Hence a feverish state is induced which is antagonistic to fat-digestion; and as excretion from the skin is checked, and exhalation of carbonic acid is increased, extra work is thrown upon the lung, so that moisture may, by these combined actions, become an exciting cause of phthisis pulmonalis where the predisposing habit already exists. Dry hot air is, therefore, more easily borne than moist, and the advantage of a dry climate such as Egypt may depend upon the diminished heat of body from lessened oxidation and increased perspiration.

(*e.*) Sleep and waking have a most important influence on oxidation. Professor Pettenkofer has quite lately shown most conclusively "that large quantities of carbonic acid are produced during the day in waking, whether we work or not, and that the absorption of oxygen during the day is comparatively trifling; while at night, during sleep, large quantities of oxygen are absorbed and stored up in the system, in order to enable us to compensate the previous extra waste of oxygen, and to be again prepared on the day following for the requirements of waking life."* According to his experiments, oxidation would appear to be a much less simple process than hitherto supposed, and the oxygen is probably occupied in various stages of oxidation within the system before the ultimate products of combustion—viz., carbonic acid and water—are formed. These experiments accord perfectly with, and therefore derive support from, those previously made on animals during hybernation. Certainly the above conclusions throw great light upon the habitual non-digestion of fat as a cause of phthisis, for in this disease no conditions are more constant in their operation than those to which we are subjected while sleeping. However varied our occupations and surroundings may be during the day, night after night we are under almost the same influences. The importance of close sleeping apartments in the production of phthisis has long been recognised; and, looked at in the light of these investigations, it cannot well be over-estimated. Amongst the poor of our large towns this cause must operate most powerfully; for, in addition to the numbers usually crowded into each room and closet, in winter every means is taken, on account of the scarcity of fuel, to prevent the free access of air. In the better classes closely curtained beds, and heated bedrooms during the cold season, have a somewhat similar effect, and the little inhabitants of the nursery, who, proportionately to weight, should absorb very much more oxygen than adults, are often crowded into an ordinary sleeping apartment, with the addition of nurses, and not unfrequently one room serves the double purpose of night and day nursery. Here, therefore, in both classes we have a constant source of deficiency of oxygen in the blood, and consequently of lessened demand for fat in the food. These experiments of Pettenkofer throw much light upon the large amount of carbonic acid given off, according to Dr Edward Smith, during the early hours of the day, and the diminishing exhalation in the evening.

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* See "Medical Times and Gazette," 1866 and 1867.

(*f*.) Impure air was believed by Baudelocque to be the true and probably the sole cause of phthisis; and experiment has shown that relative purity or impurity of the air affects the amount of carbonic acid given off by the lungs considerably. Thus, if any amount of carbonic acid was present in the air, the quantity exhaled was lessened. When 300 cubic inches of air were repeatedly breathed for three minutes, only 9·5 per cent., or 28·5 cubic inches in all, were given off, although, when fresh air was breathed at every inspiration, the amount exhaled was 32 cubic inches per minute. In badly ventilated rooms, therefore, a deficiency of oxygen operates at night, and an excess of carbonic acid during the day, in the establishment of a lessened demand for fats.

(*g*.) Muscular exertion increases the quantity of carbonic acid exhaled, both during its continuance and for some time afterwards. But exercise is principally a cause of the digestion of albumen; for great muscular exertion causes the albuminous compounds to be broken up, force and heat being the result. Thus, to a certain extent, the necessity for highly carbonaceous substances is diminished. Hence we find that in training fat is avoided. When training is suddenly left off, the habitual non-digestion of fat being thus more or less established, and the amount of albumen decomposed in the system being insufficient to keep up the heat of the body, the balance is apt to be disturbed, and tubercle deposited. Hence many athletes die of phthisis.

(*h*.) The quality and quantity of the food supplied must directly influence the exhalation of carbonic acid and the habits of digestion. The scarcity and high price of good milk, butter, eggs, and fat butchers' meat, in large towns, has much to do with the development of the habitual non-digestion of fats in early life; and the much greater tendency to phthisis in towns than in rural populations must owe its origin to this cause, amongst others, especially when taken in connection with insufficient clothing.

(*i.*) The depressing passions and great mental exertion have both the effect of diminishing the amount of carbonic acid exhaled,—probably by lessening the number of pulsations and respirations.

We have thus briefly reviewed the conditions which chiefly influence the oxidation of carbon in the body, and which either lessen or increase the demand for fatty substances in the food. It must strike every one that those which lessen the exhalation of carbonic acid are exactly those which, when operating for a length of time, are recognised as the chief causes of tuberculosis. But, as fat-digestion is admitted to be dependent upon the combustion of carbon in the body, it may naturally be asked, Is not deficient oxidation the first link in the chain of causation? I think not, for it seems probable that, to the extent that there is fat in the fluids of the body to be oxidised, the system will respond to the demands made upon it by external conditions, and that in this readiness to be influenced by those agencies which promote the oxidation of carbon, we have the explanation of the mode in which the exciting causes of the disease act. Suppose, for example, that, in a certain man, through the long-continued influence of heat, the power to digest fat has become lessened; let this man now be at once exposed to the influence of continued cold, and, no reserve of fat being habitually supplied for the purpose of keeping up the heat of the body under such a temperature, that which is intended for tissue-formation is drawn upon, and deficient tissue renewal is the result. That the faulty action is to be looked for in the digestive organs may be further inferred from the fact that, when we get cod-liver oil to pass into the system, oxidation seems to proceed perfectly. Admitting, then, that the digestive organs are at fault, I think that the explanation here given is more satisfactory than any other.

4. *In the treatment of this condition the indications are, to break this habit and to restore the lost power of digestion of oils.*—We have seen that there is every reason to believe that the condition which really favours the development of tubercle is a habit of digestion, and we have examined one by one the various external influences to the continued operation of which its formation must be attributed. In seeking to effect a cure in the early and remediable stages of the disorder, it will therefore be our endeavour to correct this habit.

5. *This is to be best done by supplying in increased force what we find to be the chief stimulants to the digestion of fat.*—Having already considered in detail what these are, we shall avoid doing so again. Our success in the treatment will depend on our bringing into operation in each case a suitable combination of these conditions. In all cases the food is the chief thing to be attended to. The importance of this has long been recognised, and the matter of late years successfully studied. The result is that we are in possession of the two very easily digested substances, cod-liver oil and the pancreatic emulsion. These will pass into the system under many unfavourable circumstances; but, for reasons stated at the outset, they are not nearly so useful as they might be were they given under such circumstances as would operate powerfully in causing a demand for them in the system.

It is the fact that we possess fatty substances which will so readily pass into the blood, which makes us hope most from that treatment which we propose. If we had not the assistance of these first steps in fatty food, we might have some hesitation in urging these doctrines so strongly, as there might be some risk during the period which would elapse before ordinary fats could be digested. But in favour of cod-liver oil there is much more to be said. When we have the first indications of tuberculosis presented to us, a certain amount of tubercular exudation has usually already taken place, and in our endeavour to cure the disease we have two indications to fulfil. First, in order to restore weakened tissue and prevent its further destruction, a properly constituted molecular fluid must be supplied to the blood. This will not, however, of itself suffice to remove previous exudation. Now we know, from their effects on enlarged scrofulous glands, that bromine and iodine both promote absorption of the exudation to a certain extent, even when given in our clumsy formulæ. The second indication, then, being the removal of this exudation, we have in cod-liver oil, ready-made by a living animal organism, a combination of these medicinal substances with an easily digested oil most suitable for application to a living structure. Thus, in administering cod-liver oil we with one substance fulfil both indications. Moreover, by having our medicines organically united with the reparative fluid, we insure their reaching and being brought into the most intimate relationship with the weakened tissues in the process of their renewal. Their operation being thus inseparably connected with the vital changes in the diseased parts, we can readily understand how small doses of these agents will, in this way, act much more powerfully than much larger quantities of the same substances administered in forms which have no affinity to the diseased structures. I should not class the pancreatic emulsion along with cod-liver oil, as, although both are easily digested, they are opposed to each other in their effects, the former being merely palliative, while the latter is truly curative. The emulsion, by supplying along with the fat the secretion which should digest it, removes the natural stimulus to the restoration of that secretion. Administered with the cod oil, and gradually giving place to the latter, its use may be attended with benefit at the commencement of that stimulating treatment which I recommend, by supplying the body from the first with a sufficiency of carbon, and thus preventing any risk that might attend the change from a warmer to a colder climate with increased oxidation.

To remedy defective nutrition by getting oil into the system, and to restore to the digestive organs the power of doing so habitually, being our aim, all other questions will be measured by their bearing upon this. With a view to this end the question of climate is of paramount interest. The climate of any locality is, for our present purpose, a combination in its atmosphere of certain conditions influencing the oxidation of carbon in the body. A favourable combination is to be met with only in certain places, and cannot be created at will elsewhere; whereas all other conditions having a similar influence may be supplemented anywhere. Thus a particular temperature, moisture, and density of the atmosphere, cannot properly be commanded in any locality at will; but we can regulate our food, clothing, exercise, and ventilation as we please, wherever we are.

Now, so little care has been taken in discriminating between the different stages of the disease in all the statistics and observations which we have regarding the influence of climate in tuberculosis, that they are more contradictory and confusing than useful. The conclusions to which I have come are, that in the earlier stages of the disease, especially that of predisposition to it, those conditions which favour the oxidation of carbon in the body will be most beneficial and truly curative ; whereas on the other hand, in advanced cases in which cure cannot be expected, and we can merely hope to prolong life by palliation, benefit will be derived from the moderate influence of those conditions which check the consumption of carbon. In the former case a cool bracing dry climate should be sought, and the use of large well-ventilated rooms at night, with plenty of exercise in the open air by day ; only a sufficient amount of clothing to prevent chill (that next to the skin being woollen), baths gradually reduced in temperature, and a graduated scale of oleaginous food, should be assiduously yet cautiously persevered in. In most countries elevated situations, with diminished density of the atmosphere, will be preferable. In cases of hereditary transmission, perfect cure may be impossible in one generation, although great benefit will be derived from perseverance in the course advised. In cases of advanced disease we may choose a milder climate, warmer clothing, with perhaps a more humid atmosphere (?), and the pancreatic emulsion will pass more readily into the system than other forms of oil. Such palliative measures will also be advantageous in acute attacks at the outset of the disease, for the purpose of lessening functional activity until inflammatory action has ceased, when we may cautiously commence the more bracing and truly curative treatment.

6. *And now, in conclusion, summer is more to be dreaded than winter in the tubercular diathesis, and safety to be sought rather in choosing a cool bracing climate in the former season than in the opposite and usual course.*—It may be urged against this proposition that most attacks of phthisis are found to take place in winter. I grant this; but I believe that the predisposition to these attacks is chiefly established during summer. The taste for fats

which each winter more or less developes, continuing on into summer, is the real predisposing cause of those bilious attacks which are so common in the latter season, the unnecessary accumulation of rich materials in the blood being their cause. In like manner the deficient digestion of, and dislike to, fats, which are the result of summer heat, continuing on into winter, are the cause of those acute attacks of phthisis which are so common then, the greater consumption with diminished supply of fat causing a disturbance in the relative proportion of the oil to the albumen in the nutritive fluid. In many cases, as we have already hinted, the salutary and counterbalancing influence of winter has for years been annulled by confinement to close apartments, too warm clothing, and insufficient exercise during the cold weather, and thus the morbid habit has become developed. For such reasons, seeing that the evil effects of too long-continued imitation of a summer temperature, with many other aggravations, have much to do with the origin of the malady we are dealing with, I think it highly advisable that this mischief should be checked by avoiding any exposure to those conditions which have given rise to it, and that we should endeavour, by a continued exposure to a bracing degree of cold, with the other means already mentioned, perseveringly to conquer inch by inch the ground that has been lost, until the habit of fat-digestion has been perfectly established and health restored.

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